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New and Noteworthy Records of Mosses from Mindoro, the Philippines, and Their Biogeographical Implication

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Abstract

A recent, small collection of mosses from Mt. Halcon, Mindoro Island, the Philippines, has yielded two new records for the country (*Rhacocarpus alpinus* (Wright) Par. and *Dicranoloma daymannianum* Bartr.) and eight new records for the island. Relevant ecological, morphological and biogeographical notes for the 15 species collected are provided.

Introduction

Floristic exploration was conducted from 1996—1997 around the summit of Mt. Halcon in Mindoro, the seventh largest island in the Philippines (Fig. 1). The actual summit stands at 2,582 m asl and has a grid coordinate of 13° 15'46" N and 120° 59'29" E. The exploration was carried out principally to classify and describe the vegetation types found on the northeastern summit zone (Mandia, 1998). In addition to a good number of new records of vascular plants for the island and the Philippines that will be reported separately by the second author, the exploration has yielded two species of mosses new to the country (*Rhacocarpus alpinus* and *Dicranoloma daymannianum*), and eight new records for the island. In the case of little known moss flora of Mt. Halcon, these additions are rather significant. Furthermore, the new records highlight the Mindoro-Palawan connection, a noteworthy feature of the island's biogeography.

Summit Vegetation

The summit vegetation of Mt. Halcon extends from 1,950 to 2,582 m altitude and consists largely of open, low growing species of *Leptospermum*,

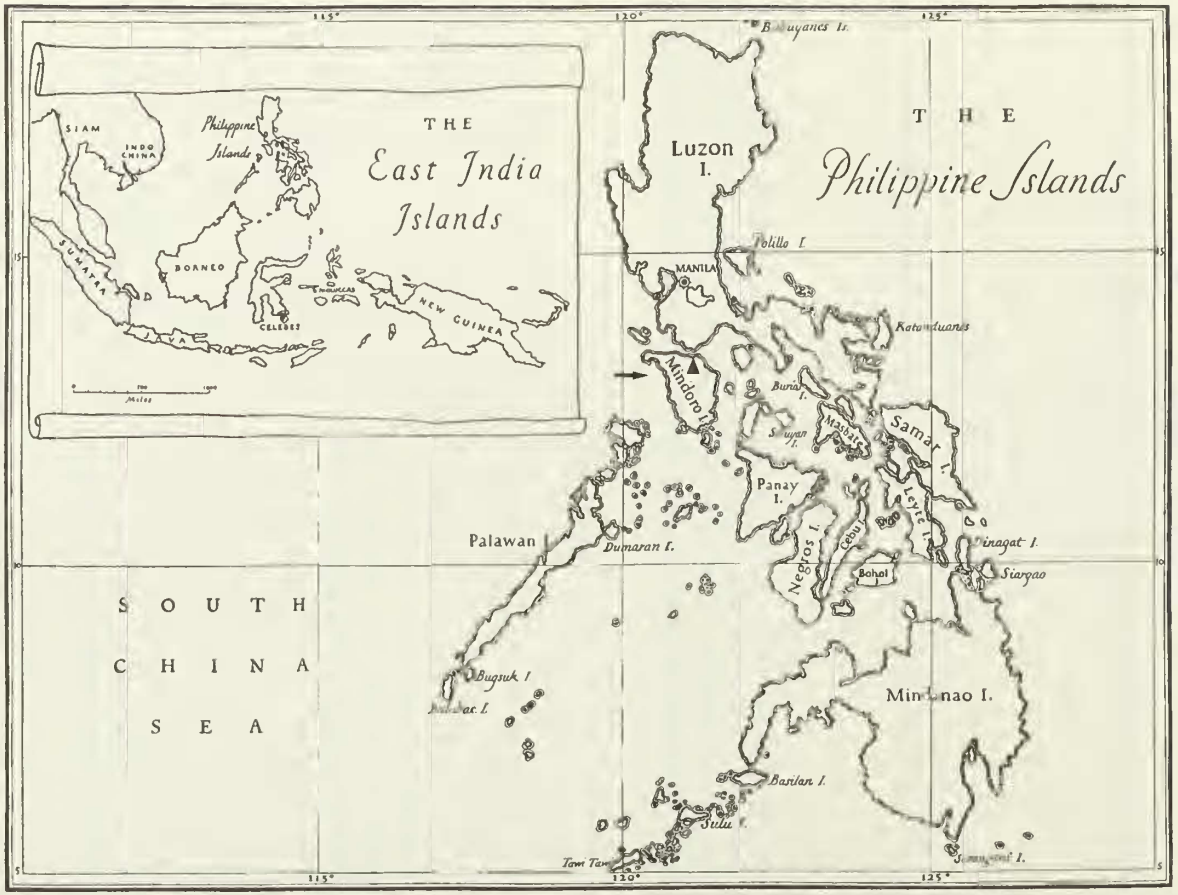

Figure 1. The location of Mt. Halcon (▲) on Mindoro Island, the Philippines

podocarps, ericoids, sedges, lycopods, ferns, ground lichens and bryophytes, interrupted by patches of shrubs and mossy forest. Vascular cushion plants and geophytes, such as the sundews (*Drosera*), *Centrolepis philippinensis* Merr. (Centrolepidaceae), *Trachymene saniculifolia* Stapf (Umbelliferae), *Aletris foliolosa* Stapf (Melanthiaceae), *Oreobulus ambiguous* Kukenth. & Steenis (Cyperaceae), *Patersonia lowii* Stapf (Iridaceae), *Gentiana luzoniensis* Merr. (Gentianaceae), *Schoenus melanostachys* R. Br. and *S. curvulus* F. Muell. (Cyperaceae) abound. The soil is shallow, acidic and oligotrophic, deriving from mica schist and white quartz.

Geological Origin and Biogeography of Mindoro

Little is known about the geology and geological history of Mt. Halcon, except that the mountain mass consists of mainly metamorphic rocks of continental crust origin uplifted since mid-Miocene (Fernandez, 1982; JICA-MMAJ, 1984). Geologically, Mindoro, with Mt. Halcon, is interesting, being ascribed to be part of a Tertiary micro-continent, the North Palawan Block (Holloway, 1982). Others, such as Hamilton (1981), included only the southern Mindoro in the North Palawan Block, giving the northern portion a separate origin. The arrival of North Palawan Block from its pre-drift position contiguous with the south China mainland to its present day position in the Philippine archipelago has been postulated to be in mid- to late Pleiocene (Holloway, 1982; Hall, 1996, 1998). The event became a crucial step in the evolution of the modern Philippine biota because the resulting island chain provided the necessary land habitats for two-way migrations of plants and animals between Borneo and Luzon. Furthermore, the drifting of the ancient North Palawan Block across the South China Sea might also have carried with it some continental Asiatic plants and animals, which have become incorporated into the Philippine biota (Tan *et al.*, 1988). Seen in this light, the study of Mindoro mosses becomes relevant in understanding the biogeography of the island.

Floristic Affinity of Mindoro Mosses

Floristically, the vascular plant flora of Mindoro has been identified more with the Luzon flora than with the Palawan flora (Merrill, 1928). Its incompletely known moss flora also supported a strong Luzon connection (Tan and Iwatsuki, 1991). It is therefore of phytogeographical significance that *Rhacocarpus alpinus, Dicranoloma daymannianum* and *Acroporium johannes-winkleri* were identified among the new collection of mosses from Mt. Halcon. These three Malesian taxa are widespread in distribution, at

least in Borneo, but had either no prior Philippine record in the case of *R. alpinus* and *D. daymannianum*, or were not previously known from Mindoro, like *Acroporium johannes-winkleri* Broth. For all three taxa, Mt. Halcon represents the northernmost penetration of their ranges in Malesia north of the equator.

Rhacocarpus is a widespread austral genus of 7 species (Frahm, 1996), with *R. alpinus* distributed from Sumatra, Borneo, Sulawesi to New Guinea (Koponen and Norris, 1986). Its presence on Mt. Halcon shows the Gondwana influence on the mountain flora, albeit a tenuous one, which hitherto had not been apparent. The Mt. Halcon record also foretells the likely presence of this species in Palawan. Likewise, the new Mindoro record of *Acroporium johannes-winkleri* reinforces the important role of Palawan as a Pleistocene land bridge in the island hopping of mosses in the area. Earlier, Tan (1994) reported *Acroporium johannes-winkleri* from two localities in Palawan, and one locality each from Mindanao (Mt. Apo) and Sibuyan Island (Mt. Giting-Giting).

It is worthwhile to note that eight moss taxa reported from Mindoro (see below) have no Palawan record. Under-collection is one reason for this phenomenon. Compared with Mindoro, however, Palawan has a better known moss flora owing to the four recent explorations undertaken between 1987—1993 by the senior author (Tan, 1996). An alternative explanation for the dissimilar distribution of taxa in these two islands may lie in the relatively "short" time available for the full exchange of biota since the late Pliocene when the two islands drifted close to each other geographically.

Annotation of the new collection of Mt. Halcon mosses

Below we present the list of 15 moss species collected from Mt. Halcon, together with brief comments on their morphology and ecology. The collection numbers belong to the second author, with voucher specimens deposited at SINU and herbarium of De La Salle University-Manila campus.

The single asterisk (*) indicates a new record for Mindoro, and double asterisk (**), new to the Philippines.

**Acroporium johannis-winkleri* Broth. [EHM 78]. Epiphytic on branches, this is a medium-sized *Acroporium* with rather stiff-looking and spreading leaves. Stems measure to 2 cm tall. It is a West Malesian endemic, being common in Peninsular Malaysia and Borneo.

Braunfelsia dicranoides (Dozy & Molk.) Broth. [EHM 82]. This dicranaceous moss is easily recognized among its congeners by the

strongly falcate, non-plicate and unicostate leaves. Its long, sheathing perichaetial leaves are also diagnostic. It is a common mossy forest epiphyte throughout Malesia.

**Breutelia arundinifolia* (Duby) Fleisch. [EHM 76, 83]. This large moss is recognized by its big antheridial head, widely spreading to somewhat squarrose and sheathing leaves, and tomentose stems (cf. Virtanen, 1997). Widespread in East Asia and Oceania, the species is a common ground dweller on open sites at high elevations in the Philippines. It has no Palawan record (Tan, 1996).

**Campylopus exasperatus* (Nees & Blume) Brid. [EHM 77]. This is an easily recognized *Campylopus* in the Philippine mountains. The leaves are often broadly lanceolate, acute to blunt, with a percurrent and broad costa that is poorly defined. The plants from Mt. Halcon are large, measuring to 12 cm tall and carpeting the soil underneath the *Falcatifolium* forest and heath vegetation.

**C. hemitrichius* (C. Muell.) Jaeg. [EHM 86, 92]. Distinctive in having narrowly lanceolate leaves with concolorous, excurrent costa, this species is a ground dweller in open sites at the summit of Mt. Halcon. There seem to be two ecotypes on this mountain, one with erect, appressed leaves and the other with somewhat secund leaves. Tan (1983) clarified the taxonomic confusion of this species vis-à-vis other related Philippine congeners. At present, *Campylopus hemitrichius* has no Palawan record.

Dicranoloma assimile (Hampe) Par. [EHM 84]. This is a widespread *Dicranoloma* in Philippine mountains growing mainly on trunks and branches, sometimes on soil.

***Dicranoloma daymannianum* Bartr. [EHM 85]. Found attached to the base of trunks and branches of shrubs in the *Podocarpus-Falcatifolium* scrub, the present species resembles a small form of *D. braunii* without the filamentous propagules. The presence of a central strand in stem cross-section and the short, upper laminal cells further distinguish it from *D. braunii*. Klazenga (1999) discussed and illustrated well this uncommon Malesian taxon. Its presence in Palawan can be predicted.

Leucobryum javense (Brid.) Mitt. [EHM 81]. This is the largest *Leucobryum* found commonly in Philippine forests.

L. sanctum (Brid.) Hampe [EHM 80]. This is another common forest species in Malesia including the Philippines. The opening of perichetial bud of this epixylic and epipetric species are thickly covered with highly branched rhizoids that arise mainly from the abaxial side, but toward the base, of inner perichaetial leaves. The

larger outer perichaetial leaves, oddly, do not form any rhizoidal outgrowth. Yamaguchi (1993) illustrated and labeled this structure as a "tomentum" without any taxonomic comment.

**Macrothamnium javense* Fleisch. [EHM 75]. The species is found attached to prostrate branches. The strongly spinose and toothed leaf margin of this species is characteristic among its congeners. All Philippine records, thus far, are from Luzon island.

**Racomitrium lanuginosum* [EHM 90]. Growing in open heath vegetation at the summit, the species is identified by its whitish and strongly erose leaf apices. Mt. Halcon is the second locality in the Philippines for this nearly cosmopolitan moss. Its first Philippine record came from Mt. Giting-Giting in Sibuyan Island in central Philippines (Tan, 1993).

***Rhaccocarpus alpinus* (Wright) Par. [EHM 72]. This is the northernmost locality of this species in the old world tropics. The closest population to Mt. Halcon is on Mt. Kinabalu in NE Borneo. Plants are abundant on Mt. Halcon forming extensive carpets under cushion-forming seed plants. Its presence at high mountain peaks in Palawan should be sought for.

Schlotheimia wallisii C. Muell. [EHM 91]. Epiphytic on trunk bases and prostrate branches, this Malesian endemic is known from Borneo, the Philippines and New Guinea (Vitt *et al.*, 1993). The other Philippine localities include Luzon, Negros and Mindanao, but not Palawan.

Sphagnum junghuhnianum Dozy & Molk. [EHM 88]. Plants are abundant on wet soil under the thick growth of *Miscanthus* grasses. It is the most common species of *Sphagnum* in Philippine mountains.

S. sericeum C. Muell. [EHM 87]. This is the other species of *Sphagnum* found on wet soil beneath heath vegetation on Mt. Halcon. In the Philippines, this species is known also from Negros and Mindanao.

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